Energy Efficiency Measuring System and Reporting Methods

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Background of the Invention

Field of the Invention

The present invention is directed generally to a system and method for calculating changes in the energy efficiency of retail consumers of energy and reporting to those consumers and to other interested parties such as utilities, energy suppliers, regulators and other governmental agencies the results and ramifications of those changes.

Description of the Background

The cornerstone of an effective energy conservation program is the ability of the individual consumer to get a clear signal of the results of their energy conservation efforts and investments. For the vast majority of consumers, the only real measuring tool that signals the effect of their conservation efforts is their monthly utility bill. Their bill does not provide a clear signal due to changes in the weather and volatility in energy prices. Without clear feedback, consumers become less interested in attempting to control their energy usage, believing they have no control over their energy bill.

Only the largest consumers have been able to get a true understanding of the benefits of their conservation efforts through labor-intensive energy audits performed on a manual basis. Because of the high cost of these individual audits, it is not cost effective to perform them for retail consumers such as residential or small- to medium-sized commercial customers. The high cost of individual audits is driven by the need to manually process usage and weather data, individually deal with data deficiencies and to make manual adjustments for incomplete or inaccurate information. In manual audits, model selection occurs at the discretion of a human

5   auditor, although there have been some attempts at automated model generation, such as the

Prism approach, described in Fels, M., "PRISM: An Introduction", Energy and Buildings, 9 (1986),

pp. 5-18.

Utilities may develop a prediction of a consumer's usage at "normal" weather. Typically

they do so by developing a linear fit between usage and weather and applying that fitted model to

10   normalized weather. Those equations could be used in theory to calculate individual changes in

energy efficiency. However, the accuracy of this method is not sufficient for these calculations.

The Prism approach attempts to overcome this deficiency by the inclusion of a household specific

variable tau. However, the Prism model effectively forces all households into the same equation

structure of a linear regression. Prism also calculates a normal annual consumption in its

15   determination of efficiency, and does not use the current weather condition to determine

efficiency at that weather condition. The present invention chooses the optimal model structure

for each consumer. The Prism approach develops a baseline and a non-baseline model for each

consumer and exercises both models on normalized weather. The Prism approach is thus

subject to numerous shortcomings including model inaccuracy far exceeding the change in

20   normal consumption and errors caused by non-constant period lengths that can obscure the

changes in efficiency.

An automated system and method for calculating changes in the energy efficiency of

retail consumers of energy and reporting to those consumers the results and ramifications of

those changes is needed such that the transaction cost of providing this information to retail

25   consumers will be reduced such that it will be cost effective.

Using the present invention retail consumers can see the results of their behavioral

changes such as resetting their thermostats, purchasing more energy efficient products such as

sub-compact fluorescent light bulbs, high efficiency heating and cooling units and EnergyStar®

compliant electronics and home-improvement projects such as installing additional insulation,

30   stopping air leaks and installing storm doors and windows. Retail consumers will enjoy the same

benefits currently available only to large commercial, governmental and industrial consumers

through expensive, labor-intensive processes.

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5   Efficiency changes in the context of the present invention are defined as changes to the whole consumption pattern related to a physical structure such as a house, apartment or commercial establishment. Efficiency includes considerations of equipment, consumer behavior and the physical aspects of the structure and space within.

        Thus, there is a need for a system and method of measuring changes in energy

10   efficiency for individual energy consumers at the retail customer level and reporting the results of that measurement to those consumers. In addition, there is a need for better reporting of individual and aggregate energy efficiency changes to utilities and third parties such as energy suppliers, regulators and other governmental agencies.

Summary of the Invention

15   The present invention is directed to a method of receiving, processing and reporting data regarding retail consumers' energy usage and weather in large batches. For each group of energy usage data to be processed, accurate historic weather data for multiple weather stations must be acquired. Weather data received may include Heating Degree Days, Cooling Degree Days, Relative Humidity, Dew point, Atmospheric Pressure and Precipitation. These data may be

20   transmitted over a communication link such as, for example, the Internet, telephone lines or by computer readable media such as, for example, magnetic or optical storage media. Distribution can also be accomplished by distribution to a central storage site on the public Internet, an intranet, a local area network (LAN), a wide area network (WAN) or a direct connection for further access or distribution.

25   The data received for each weather station may be missing some data points or contain gross inaccuracies. The present invention detects missing or grossly inaccurate data points and correctly "fills" the data using a variety of algorithms including but not limited to regressions, average replacements, deltas off of adjacent weather stations, deltas off of prior points, average prior and subsequent point and strategic estimates.

30   Each batch of energy usage data to be processed includes electronic data regarding anywhere from, for example, a few thousand to several million individual retail consumers. For

5   each consumer, data regarding, for example, up to 24 months of usage is included. Data for

each usage period for each consumer may include individual consumer record keys such as

account number, sufficient location information to identify the appropriate weather station,

consumption information including meter read data and dates, type of meter read which may

include actual, estimate, correction and other billing information. In addition, contact information

10   such as name, address and phone number may be included for reporting purposes.

The energy usage data (consumption in volumes of fuel such as gallons, MCF's, and

pounds, etc., or energy units such as kWh, therms, BTU's, etc.) with related information about the

periods of consumption such as starting date and number of days in a period, ending date and

number of days in a period, starting and ending dates or a series of days in a period with a

15   beginning or ending offset sufficient to determine the starting and ending dates of each

consumption period received from, for example, the utility or energy supplier, may contain known

data structure problems such as overlapping or missing meter read periods, invalid dates, such

as February 30, invalid years such as 1901 appearing in a data set containing 2001 data, bad

estimates, bad meter reads and accounting corrections, including those previously mentioned,

20   and cancels and rebills. The present invention examines the data for these and other problems

and repairs or removes problematic data elements using a variety of algorithms including but not

limited to artificial intelligence, regression technology, analysis of variance, outlier analysis and

human inspection.

The present invention examines the cleaned data for a baseline period and develops

25   individual mathematical baseline models representing usage patterns for each consumer. The

models may include but are not required to use or limited to the analysis of base non-weather

related use, usage sensitive to changes in weather, temperatures at which the consumer turns on

or off their heating and/or cooling systems, humidity, precipitation, wind speed, cloud cover, and

trend variables.

30   The present invention then exercises the baseline models for each consumer using data

representing actual weather that occurred in a period subsequent or prior to the baseline period

to determine each consumer's Actual Weather Consumption Estimate (AWCE).An alternate

5   method is to develop a baseline and a non-baseline model for each consumer and to exercise

both models over a consistent period of either actual or normalized weather.

Additional usage data for the individual consumers are received from, for example, the

utility or energy supplier. These data correspond to the same period for which the AWCE has

been calculated. Alternately these data may be received with the original data set.

10   The present invention then compares the AWCE to the actual usage in the same period

to determine changes in the consumer's energy usage patterns. The changes detected may be

caused by changes in equipment, additions or removal of equipment such as replacing existing

appliances with more efficient models or by consumer behavior changes such as changing

thermostat settings, turning off unused equipment or limiting use of inefficient equipment.

15   The present invention prepares data to be reported to the consumer in an easy-to-

understand format. Such information may include the quantity of energy used that is greater or

less than the AWCE and the value of that energy usage in dollars. Additional information may be

prepared including the environmental impact of the consumer's energy efficiency change such as

the pounds of emissions avoided or caused, the quantity of raw materials saved or used as a

20   result of the consumer's energy efficiency change and the societal impact such as the additional

generation facilities needed or avoided by the energy efficiency change. This information is from

average parameters related to the specific fuel consumed based on an industry, state or utility

system. Further information may be provided to the consumer regarding recommendations for

energy efficiency improvements and the potential benefit of those improvements.

25   Aggregate results at the utility, state or national level may also be included so the

consumer may compare their personal results to those of a larger group.

The present invention includes a quality assurance method that randomly pulls a sample

of individual consumer calculations to be compared to a hand calculation performed by the

system operator or parallel operation performed by a second system. In addition, issues that are

30   missed in the data cleanup may be determined at this stage. A system of prescribed reality

checks using tests of known ratio ranges also are used to detect problems with modeling or data

cleaning. The quality assurance step is important and should not be avoided. This step is crucial

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5   in establishing credibility with consumers and other interested parties such as regulators,

legislators and utilities.

The present invention includes methods of communicating results of the energy efficiency

change calculation to the individual consumers, the utility, and any other interested parties.

These methods may include but are not limited to transmission of data over a communication link

10   such as, for example, the Internet, public databases, telephone lines or by computer readable

media such as, for example, magnetic or optical storage media. Distribution can also be

accomplished by distribution to a central storage site on the public Internet, intranet, a local area

network (LAN), a wide area network (WAN) or a direct connection for further access or

distribution. Further communication methods to consumers may include direct mail, telephone

15   communications, e-mail, personal visits, facsimile and public communications such as radio and

TV broadcasting or billboards.

The message communicated to each consumer may take the form of an energy

efficiency index, a percentage change in energy efficiency, actual quantity of energy efficiency

variance, the dollar value of energy efficiency variance and values that may be inferred from the

20   energy efficiency variance such as quantities or percentages of pollutants created or avoided.

This information may be presented as a bar chart or a graph in addition to the stated numbers.

Brief Description of the Drawing

For the present invention to be clearly understood and readily practiced, the present

invention will be described in conjunction with the following figures, wherein:

25   Fig 1 is a diagram illustrating the energy efficiency measurement system and reporting

system of the present invention;

Fig 2 is a diagram illustrating another embodiment of the energy efficiency measurement

system and reporting system of the present invention that does not utilize a system database;

Figure 3 is a diagram illustrating an embodiment of a process flow of an efficiency

30   calculation; and

5   Figure 4 is a diagram illustrating another embodiment of the process flow of the efficiency

calculation.

Detailed Description of the Invention

It is to be understood that the figures and descriptions of the present invention have been

simplified to illustrate elements that are relevant for a clear understanding of the present

10   invention, while eliminating, for purposes of clarity, other elements found in a typical computer

system. For example, specific operating system details and modules and specific database

management details and modules are not shown. Those of ordinary skill in the art will recognize

that other elements may be desirable to produce an operational system incorporating the present

invention. However, because such elements are well known in the art, and because they do not

15   facilitate a better understanding of the present invention, a discussion of such elements is not

provided herein.

Figure 1 is a diagram illustrating an energy efficiency measurement system and reporting

system 10 of the present invention. Usage data 12 contained within a database for individual

consumers or provided by individual consumers are transmitted over a communication link such

20   as, for example, the Internet, telephone lines or by computer readable media such as, for

example, magnetic or optical storage media. Distribution can also be accomplished by

distribution to a central storage site on the public Internet, an intranet, a local area network (LAN),

a wide area network (WAN) or a direct connection for further access or distribution. Data

transmitted for large numbers of consumers are likely to include individual consumer record keys

25   such as account number, consumption information including meter read data and dates, type of

meter read which may include actual, estimate, correction and other billing information. In

addition, contact information such as name, address and phone number may be included for a

Individual Report Generation Module 14. Additional information may be required such as

conversion factors from energy units to alternate energy units or dollars. This data transmission

30   may occur at one time or many times throughout the process.

5   Generic Import Module 16 accepts the usage data 12 and imports the data 12 into the appropriate positions in a System Database 18.

Data Cleaning Module 20 examines the data for known data structure problems such as overlapping meter read periods, invalid dates, bad estimates, bad meter reads and accounting corrections including those previously mentioned and cancels and rebills. In addition, the Data

10   Cleaning Module 20 repairs or removes problematic data elements.

Weather data 22 are transmitted over a communication link such as, for example, the Internet, telephone lines or by computer readable media such as, for example, magnetic or optical storage media. Distribution can also be accomplished by distribution to a central storage site on the public Internet, an intranet, a local area network (LAN), a wide area network (WAN) or

15   a direct connection for further access or distribution. Weather data 22 received may include Heating Degree Days, Cooling Degree Days, Relative Humidity, Dew point, Atmospheric Pressure, Precipitation, Wind Speed and Cloud Cover Percentage.

Weather Import Module 24 accepts the weather data 22 and imports them into appropriate positions in the System Database 18.

20   Weather Cleaning Module 36 examines the weather data for known data structure problems such as invalid dates or missing data. The Module 36 may also adjust for changing weather station data that are not consistent over time. The present invention fills missing data points using methods which may include but are not limited to averaging, regression, interpolation between neighboring weather stations, application of normals and application of known biases to

25   data from neighboring stations.

Unique Algorithm Generation Module 26 examines the cleaned data for a base period and develops individual mathematical baseline models representing usage patterns for each consumer. Each model may include but is not limited to analysis of base non-weather related use, usage sensitive to changes in weather, temperatures at which the consumer turns on or off

30   their heating and/or cooling systems and trend variables. The present invention works with a single algorithm in place of the Unique Algorithm Generation Module 26 with a significantly lower level of accuracy.

5   AWCE Module 28 exercises the baseline model for each consumer using data

representing actual weather that occurred in a period subsequent or prior to the base period to

determine each consumer's Actual Weather Consumption Estimate (AWCE).

Efficiency Measurement Module 30 compares the AWCE to the actual usage in the same

subsequent or prior period to determine changes in the consumer's energy usage patterns. The

10   changes detected may be caused by load growth, by changes in equipment such as replacing

existing appliances with more efficient models or by consumer behavior changes such as

changing thermostat settings, turning off unused equipment or limiting use of inefficient

equipment. Embodiments of the flow from import of consumer information and weather data

through the efficiency calculation is shown in Figures 3 and 4. The results of execution of Module

15   30 are stored in the System Database 18.

Trend Calculation Module 17 retrieves all stored results of Efficiency Measurement

Module 30 for each customer and prepares a trend analysis for that customer. The analysis may

include but is not limited to compounding percentage changes in efficiency, averaging percentage

changes in efficiency, and summing absolute changes in fuel usage. In an alternative

20   embodiment, Module 17 may be exercised using stored individual consumer algorithms from

many consumption periods to produce an efficiency trend. In this case, the functions described in

Figure 3 or Figure 4 may be executed multiple times in order to determine a trend in energy

efficiency changes.

Individual Report Generation Module 14 prepares data to be reported to the consumer in

25   an easy-to-understand format. The data may include the quantity of energy used that is greater

or less than the AWCE and the value of that energy usage in dollars. These data may be

presented as a percentage difference or an absolute difference. Additional information may be

prepared including the environmental impact of the consumer's energy efficiency change such as

the pounds of emissions avoided or caused, the quantity of raw materials saved or used as a

30   result of the consumer's energy efficiency change and the societal impact such as the additional

generation facilities needed or avoided by the energy efficiency change. A trend in the

consumer's energy efficiency changes may be included in the report. Aggregate results at the

5   utility, state or national level may also be included so the consumer may compare their personal

results to those of a larger group.

Aggregate Report Generation Module 15 aggregates the individual energy efficiency

changes and prepares summary reports to be reported to the utilities and other interested parties

such as regulators and other governmental agencies. These summary results may include but

10   are not limited to the statistical distributions of individual parameters such as percent change in

energy efficiency, expected change in energy usage at different temperatures, and aggregate

totals and averages by different reference parameters such as zip code, distribution system,

geographical location, weather station, and customer type. The aggregate results may be

grouped by one or more reference groups such as by zip code, town, weather station and

15   customer type. A reference comparison may be provided between the individual results and one

or more reference groups.

Quality Assurance Module 32 executes methods of quality control to assure the accuracy

of calculations and output. The module 32 randomly pulls a sample of individual consumer

calculations to be compared to a hand calculation performed by the system operator or parallel

20   operation performed by a second system. In addition, issues that are missed in the data cleanup

may be determined at this stage. A system of prescribed reality checks using tests of known ratio

ranges also are used to detect problems with modeling or data cleaning. This step is important in

establishing credibility with consumers and other interested parties such as regulators, legislators

and utilities. Module 32 also ensures that each input record is accounted for and ensures data

25   integrity through the Report Transmittal Module 34.

Report Transmittal Module 34 executes methods of communicating the output from

Individual Report Generation Module 14 to the individual consumers and the utility or other

interested parties such as regulators or other governmental agencies. These methods may

include but are not limited to transmission of data over a communication link such as, for

30   example, the Internet, telephone lines or by computer readable media such as, for example,

magnetic or optical storage media. Distribution can also be accomplished by distribution to a

central storage site on the public Internet, an intranet, a local area network (LAN), a wide area

5 network (WAN) or a direct connection for further access or distribution. Further communication

methods to consumers may include direct mail, telephone communications, e-mail, personal

visits, facsimile and public communications such as radio and TV broadcasting or billboards.

Figure 2 is a diagram illustrating another embodiment of the energy efficiency

measurement system and reporting system 10 of the present invention that does not utilize a

10 system database. Usage data 12 contained within a database for individual consumers or

collected from individual consumers are transmitted over a communication link such as, for

example, the internet, telephone lines or by computer readable media such as, for example,

magnetic or optical storage media. Distribution can also be accomplished by distribution to a

central storage site on the public Internet, an intranet, a local area network (LAN), a wide area

15 network (WAN) or a direct connection for further access or distribution. Data transmitted for large

numbers of consumers are likely to include individual consumer record keys such as account

number, consumption information including meter read data and dates, type of meter read which

may include actual, estimate, correction and other billing information. In addition, contact

information such as name, address and phone number may be included for Individual Report

20 Generation Module 14. Additional information may be required such as conversion factors from

energy units to alternate energy units or dollars. This data transmission may occur at one time or

many times throughout the process.

Generic Import Module 38 accepts the usage data and imports it into the memory of the

computer.

25 Data Cleaning Module 20 examines the data for known data structure problems such as

overlapping meter read periods, invalid dates, bad estimates, bad meter reads and accounting

corrections including those previously mentioned and cancels and rebills. In addition, the Data

Cleaning Module 20 repairs or removes problematic data elements.

Weather Data 22 transmitted over a communication link such as, for example, the

30 Internet, telephone lines or by computer readable media such as, for example, magnetic or

optical storage media. Distribution can also be accomplished by distribution to a central storage

site on the public Internet, an intranet, a local area network (LAN), a wide area network (WAN) or

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5   a direct connection for further access or distribution. Weather data received may include Heating

Degree Days, Cooling Degree Days, Relative Humidity, Dew point, Atmospheric Pressure,

Precipitation, Wind Speed and Cloud Cover Percentage.

Weather Import Module 24 accepts the weather data and imports them into the memory

of the computer. Weather Cleaning Module 36 examines the weather data for known data

10   structure problems such as invalid dates or missing data. The present invention fills missing data

points using methods which may include but are not limited to averaging, regression, interpolation

between neighboring weather stations, application of normals and application of known biases to

data from neighboring stations.

Unique Algorithm Generation Module 26 examines the cleaned data for a base period

15   and develops individual mathematical baseline models representing usage patterns for each

consumer. The model may include but is not limited to analysis of base non-weather related use,

usage sensitive to changes in weather, temperatures at which the consumer turns on or off their

heating and/or cooling systems and trend variables. The present invention works with a single

algorithm in place of the Unique Algorithm Generation Module 26 with a significantly lower level of

20   accuracy.

AWCE Module 28 exercises the baseline model for each consumer using data

representing actual weather that occurred in a period subsequent or prior to the base period to

determine each consumer's Actual Weather Consumption Estimate (AWCE).

Efficiency Measurement Module 30 compares the AWCE to the actual usage in the same

25   subsequent or prior period to determine changes in the consumer's energy usage patterns. The

changes detected may be caused by load growth, by changes in equipment such as replacing

existing appliances with more efficient models or by consumer behavior changes such as

changing thermostat settings, turning off unused equipment or limiting use of inefficient

equipment. Embodiments of the flow from import of consumer information and weather data

30   through the efficiency calculation is shown in Figures 3 and 4.

Individual Report Generation Module 14 prepares data to be reported to the consumer in

an easy-to-understand format. The data may include the quantity of energy used that is greater

5   or less than the AWCE and the value of that energy usage in dollars. These data may be

presented as a percentage difference as an absolute difference. Additional information may be

prepared including the environmental impact of the consumer's energy efficiency change such as

the pounds of emissions avoided or caused, the quantity of raw materials saved or used as a

result of the consumer's energy efficiency change and the societal impact such as the additional

10   generation facilities needed or avoided by the energy efficiency change. Aggregate results at the

utility, state or national level may also be included so the consumer may compare their personal

results to those of a larger group.

Aggregate Report Generation Module 15 aggregates the individual energy efficiency

changes and prepares summary reports to be reported to the utilities and other interested parties

15   such as regulators and other governmental agencies. These summary results may include but

are not limited to the statistical distributions of individual parameters such as percent change in

energy efficiency, expected change in energy usage at different temperatures, and aggregate

totals and averages by different reference parameters such as zip code, distribution system,

geographical location, weather station, customer type. The aggregate results may be grouped by

20   one or more reference groups such as zip code, town, weather station and customer type. A

reference comparison may be provided between the individual results and one or more reference

groups.

Quality Assurance Module 32 executes methods of quality control to assure the accuracy

of calculations and output. The module 32 randomly pulls a sample of individual consumer

25   calculations to be compared to a hand calculation performed by the system operator. In addition,

issues that are missed in the data clean up may be determined at this stage. A system of

prescribed reality checks using tests of known ratio ranges also are used to detect problems with

modeling or data cleaning. This step is important in establishing crucial in establishing credibility

with consumers and other interested parties such as regulators, legislators and utilities. Module

30   32 also ensures that each input record is accounted for and ensures data integrity through the

Report Transmittal Module 34.

5   Report Transmittal Module 34 executes methods of communicating the output from

Individual Report Generation Module 14 and Aggregate Report Generation Module 15 to the

individual consumers and to the utility or other interested parties such as regulators or other

governmental agencies. These methods may include but are not limited to transmission of data

over a communication link such as, for example, the Internet, telephone lines or by computer

10   readable media such as, for example, magnetic or optical storage media. Distribution can also be

accomplished by distribution to a central storage site on the public Internet, an intranet, a local

area network (LAN), a wide area network (WAN) or a direct connection for further access or

distribution. Further communication methods to consumers may include direct mail, telephone

communications, e-mail, personal visit, facsimile and public communications such as radio and

15   TV broadcasting or billboards.

Although Figure 2 does not include a Trend Calculation Module 15, a trend calculation

may be performed similarly to that described hereinabove in conjunction with Figure 1. However,

a database would be necessary to store individual algorithms or efficiencies if a long-time series

of consumption data is not input. If a long-time series of data is input, sequential calculations

20   could be performed to determine efficiency trend inputs.

Figures 1 and 2 illustrate the system 10 both with and without the system database 18.

However, it can be understood that a database (whether the system database 18 or other

database(s)) may be used for any of the calculations and reporting functions performed by the

system 10.

25   Figure 3 is a diagram illustrating an embodiment of a process flow of an efficiency

calculation. A given period's (Period N) Usage 40 and another given period's (Period M) Usage

42 are Data 12 by Consumer from Utility that have been imported using the Generic Import

Module 16,38 and processed by Data Cleaning Module 20. A given period's (Period N) Weather

44 and another given period's (Period M) Weather 46 are Weather Data 22 that have been

30   imported using the Weather Import Module 24 and processed by Weather Cleaning Module 36.

All data may be either stored in the System Database 18 or maintained in the memory of the

computer.

5   Baseline Parameter Calculation 48 includes methods of deploying Unique Algorithm

Generation Module 26 for each consumer to determine a baseline model of usage for that

consumer.

AWCE Period M 50 includes methods of calculating each customer's Actual Weather

Consumption Estimate (AWCE) by exercising the baseline model for each consumer using data

10   representing actual weather during the period representing Period M Weather 46.

Efficiency Calculation 52 includes methods of comparing AWCE Period M 50 to Period M

Usage 42 and calculating the percent change in efficiency for each consumer. If Period M is

subsequent to Period N, the calculation is any mathematical equivalent to (Period M Usage 42

divided by AWCE Period M 50) minus one. If Period N is subsequent to Period M, the calculation

15   is any mathematical equivalent to (AWCE Period M 50 divided by Period M Usage 42) minus one.

If the result is greater than zero, it represents a percentage decrease in efficiency. If the result is

less than zero, it represents a percentage increase in efficiency.

Figure 4 is a diagram illustrating another embodiment of the process flow of the efficiency

calculation. A given period's (Period N) Usage 54 and another given period's (Period M) Usage

20   56 are Data 12 by Consumer from Utility that have been imported using the Generic Import

Module 16,38 and processed by Data Cleaning Module 20. A given period's (Period N) Weather

58, another given period's (Period M) Weather 60 and another given period's (Period L) Weather

62 are Weather Data 22 that have been imported using the Weather Import Module 24 and

processed by Weather Cleaning Module 36. All data may be either stored in the System

25   Database 18 or maintained in the memory of the computer. Period L may be prior, subsequent or

concurrent to Period M. For example Period L may represent actual weather in a cold period, a

warm period, an average period, a hypothetical or a normalized period. The use of normalized

weather is similar to the Prism method and only imparts a portion of the information capable of

being provided by this model.

30   Baseline Parameter Calculation Period N 64 includes methods of deploying Unique

Algorithm Generation Module 26 for each consumer to determine a baseline model of usage for

that consumer for Period N.

5   Baseline Parameter Calculation Period M 66 includes methods of deploying Unique

Algorithm Generation Module 26 for each consumer to determine a baseline model of usage for

that consumer for Period M.

           AWCE Period N 68 includes methods of calculating each customer's Actual Weather

Consumption Estimate (AWCE) by exercising the baseline model for each consumer using data

10   representing actual weather during the period representing Period L Weather 62.

           AWCE Period M 70 includes methods of calculating each customer's Actual Weather

Consumption Estimate (AWCE) by exercising the baseline model for each consumer using data

representing actual weather during the period representing Period L Weather 62.

           Efficiency Calculation 72 includes methods of comparing AWCE Period M 68 to AWCE

15   Period M 70 and calculating the percent change in efficiency for each consumer. If Period M is

subsequent to Period N, the calculation is any mathematical equivalent to (AWCE Period M 70

divided by AWCE Period M 68) minus one. If Period N is subsequent to Period M, the calculation

is any mathematical equivalent to (AWCE Period M 68 divided by AWCE Period M 70) minus

one. If the result is greater than zero, it represents a percentage decrease in efficiency. If the

20   result is less than zero, it represents a percentage increase in efficiency.

           Although the present invention has been described herein with reference to certain

embodiments, numerous modifications and variations can be made and still the result will come

within the scope of the invention. No limitation with respect to the specific embodiments

disclosed herein is intended or should be inferred.

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